Troubleshooting and system optimization

Things to look for when the station isn't working as it should.

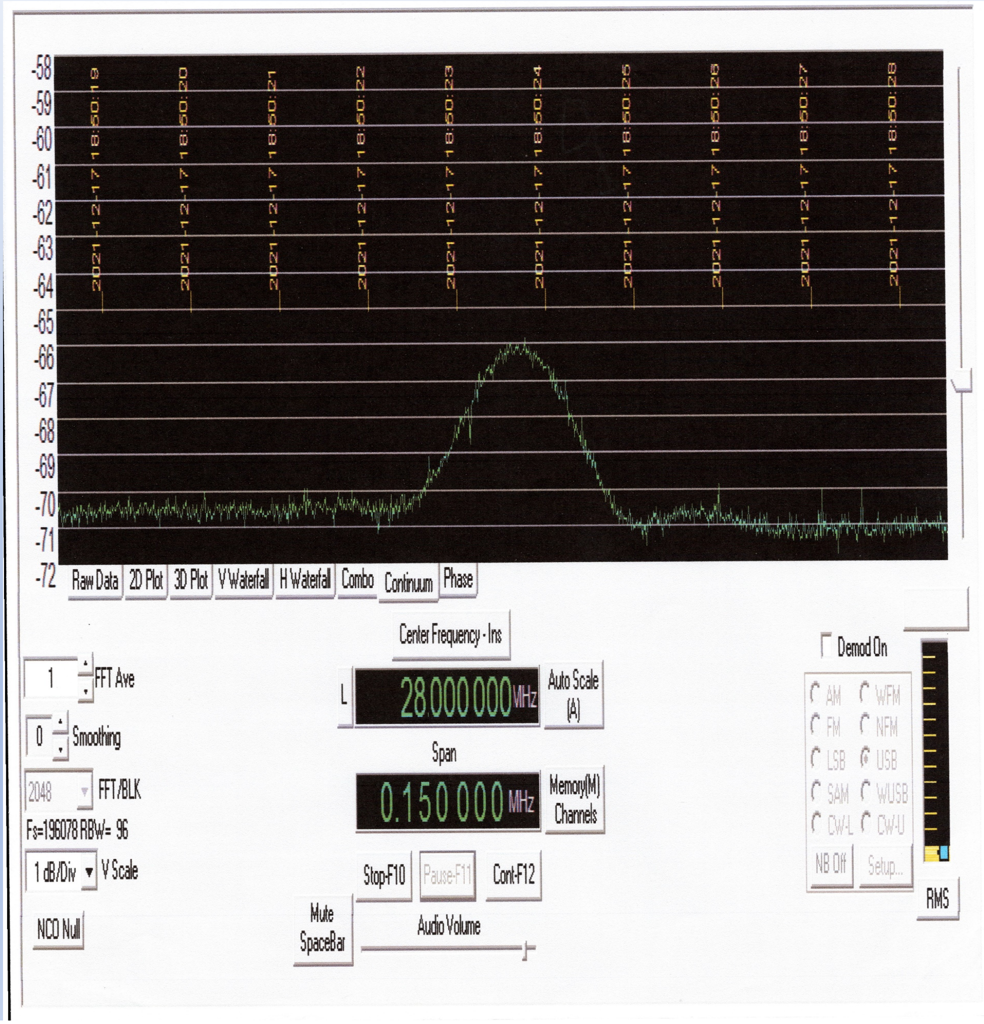
EME 2024 K1DS

How Can I Be Sure I’m Pointed at the Moon?

- Does the centered feed shadow fall on the dish center when aimed at sun? Does the Yagi beam shadow show minimum when aimed at the sun?
- Does the sun noise maximum occur when aimed at the sun?
- Do you have a camera on the moon?
- Do you have a camera on the compass rose and elevation gauge?
- Are you using manual AZ-EL or computerized? Have you tested the tracking?
- Yagi coax cables should be attached from rear, not taped along the boom.
- Is there adequate play in the cables? Is there anything that can interfere with dish or Yagi movement

Is My System Performing to Specification?

- Have you measured sun noise?
- Are you hearing and/or seeing signals on the waterfall?
- Can I hear or see my echo?
- Can you hear a local beacon?
- Can you hear a weak signal source?
- Can you hear an EME beacon?
- Can others hear/see my signal and what is the RST or digital report?
- Does it meet the VK3UM parameters?



FFT Ave: 1

Smoothing: 0

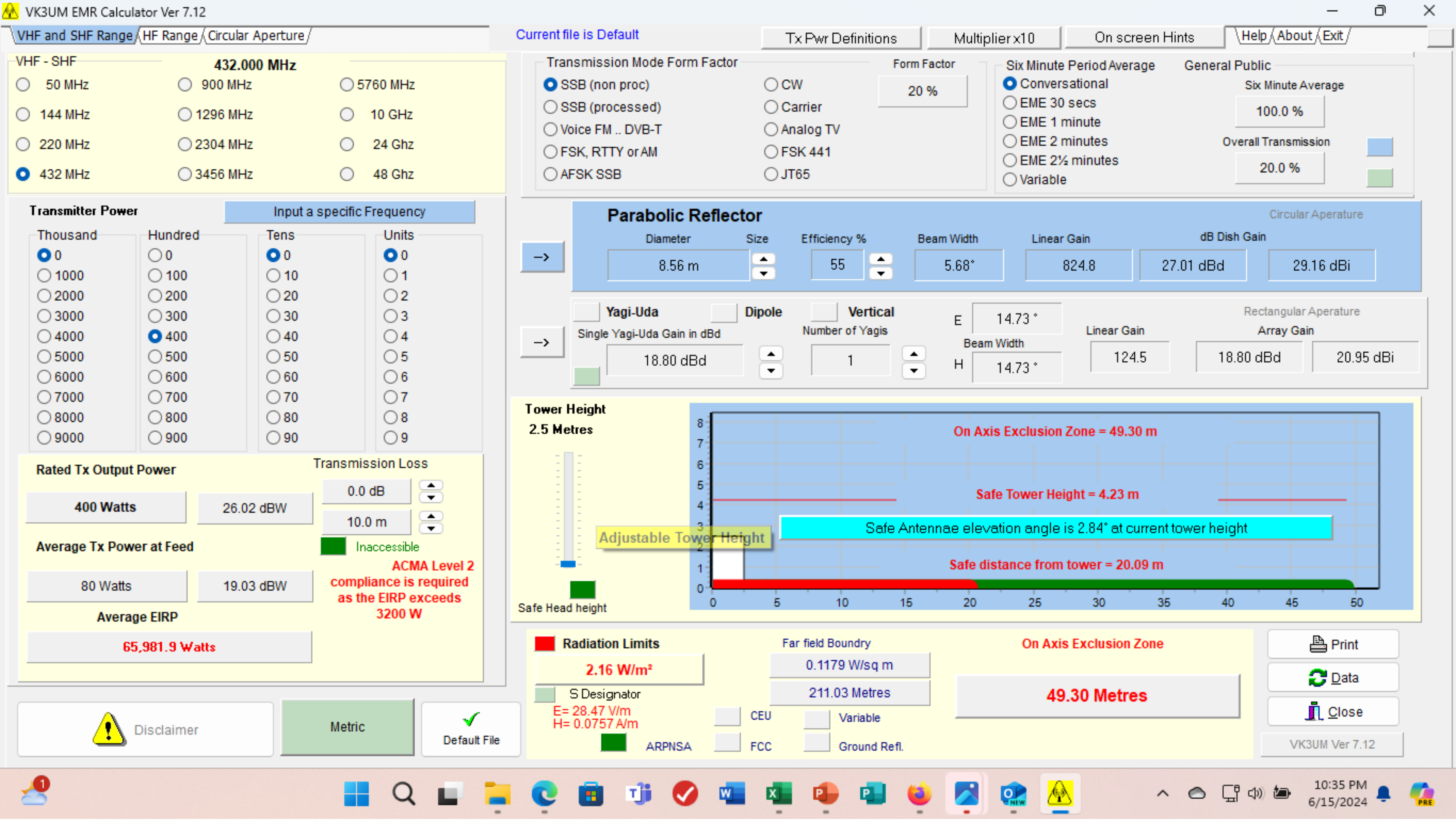
FFT/BLK: 2048

Fs=196078 RBW= 96

V Scale: 1 dB/Div

Center Frequency - Ins: 28.000000 MHz

Span: 0.150000 MHz



Current file is Default

VHF - SHF 432.000 MHz

○ 50 MHz
○ 144 MHz
○ 220 MHz
● 432 MHz
○ 900 MHz
○ 1296 MHz
○ 2304 MHz
○ 3456 MHz
○ 5760 MHz
○ 10 GHz
○ 24 Ghz
○ 48 Ghz

Transmitter Power

Thousand: ● 0 ○ 1000 ○ 2000 ○ 3000 ○ 4000 ○ 5000 ○ 6000 ○ 7000 ○ 8000 ○ 9000

Hundred: ○ 0 ○ 100 ○ 200 ○ 300 ● 400 ○ 500 ○ 600 ○ 700 ○ 800 ○ 900

Tens: ● 0 ○ 10 ○ 20 ○ 30 ○ 40 ○ 50 ○ 60 ○ 70 ○ 80 ○ 90

Units: ● 0 ○ 1 ○ 2 ○ 3 ○ 4 ○ 5 ○ 6 ○ 7 ○ 8 ○ 9

Rated Tx Output Power
400 Watts
26.02 dBW

Transmission Loss
0.0 dB
10.0 m
🟩 Inaccessible

Average Tx Power at Feed
80 Watts
19.03 dBW

ACMA Level 2 compliance is required as the EIRP exceeds 3200 W

Average EIRP
65,981.9 Watts

Transmission Mode Form Factor

● SSB (non proc)
○ SSB (processed)
○ Voice FM .. DVB-T
○ FSK, RTTY or AM
○ AFSK SSB
○ CW
○ Carrier
○ Analog TV
○ FSK 441
○ JT65

Form Factor
20 %

Six Minute Period Average

● Conversational
○ EME 30 secs
○ EME 1 minute
○ EME 2 minutes
○ EME 2½ minutes
○ Variable

General Public
Six Minute Average
100.0 %
Overall Transmission
20.0 %

Parabolic Reflector Circular Aperature

Diameter	Size	Efficiency %	Beam Width	Linear Gain	dB Dish Gain	
8.56 m		55	5.68°	824.8	27.01 dBd	29.16 dBi

Yagi-Uda **Dipole** **Vertical** Rectangular Aperature

Single Yagi-Uda Gain in dBd: 18.80 dBd
Number of Yagis: 1
Beam Width E 14.73 ° H 14.73 °
Linear Gain 124.5
Array Gain 18.80 dBd 20.95 dBi

Tower Height
2.5 Metres
Safe Head height

On Axis Exclusion Zone = 49.30 m
Safe Tower Height = 4.23 m
Safe Antennae elevation angle is 2.84° at current tower height
Safe distance from tower = 20.09 m

🟥 **Radiation Limits**
2.16 W/m²
S Designator
E= 28.47 V/m
H= 0.0757 A/m
🟩 ARPNSA
CEU
FCC

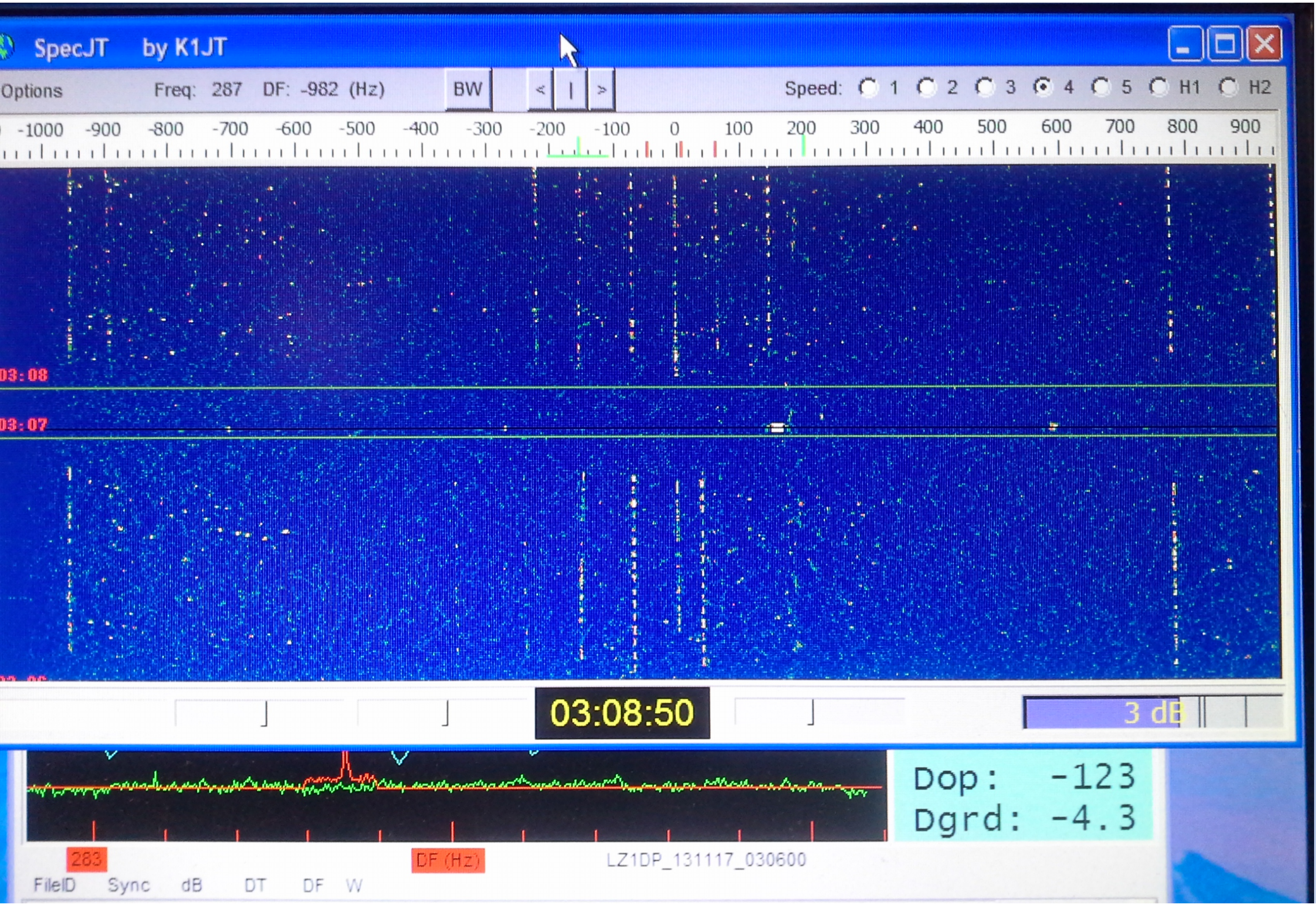
Far field Boundry
0.1179 W/sq m
211.03 Metres
Variable
Ground Refl.

On Axis Exclusion Zone
49.30 Metres

Some Simple Checks

- Are you on the correct frequency and segment of the band?
- Is the sequencer switching tested and working properly?
- Have you accounted for Doppler?
- If using digital, has the computer time been set with an accurate service?
- Are you accounting for UTC / GMT?
- If using digital, have all the proper mode, transmit sequence and waterfall parameters been set?
- Is there a power meter in the output line?

Busy JT65 activity



SpecJT by K1JT

Options

Freq: 287 DF: -982 (Hz)

Speed: ○ 1 ○ 2 ○ 3 ● 4 ○ 5 ○ H1 ○ H2

03:08:50

3 dB

Dop: -123
Dgrd: -4.3

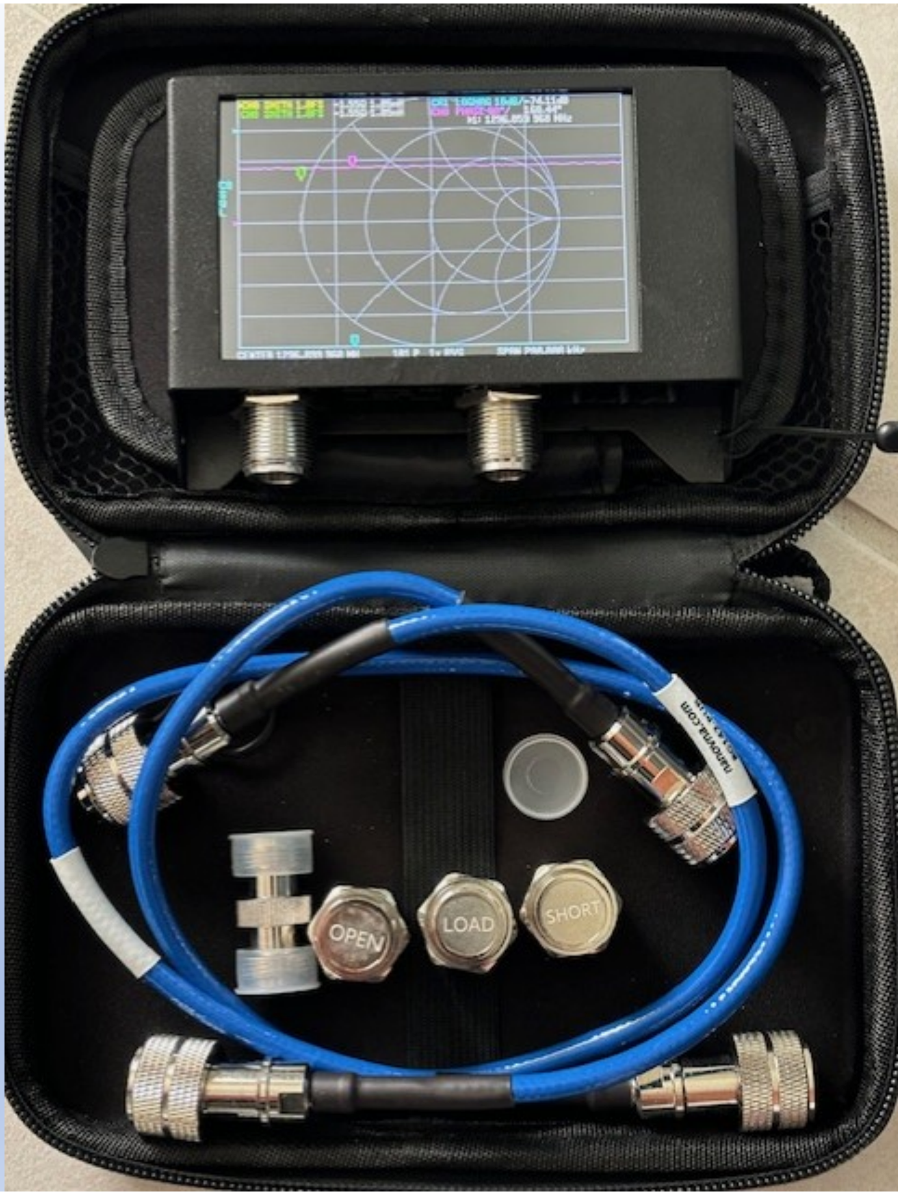
LZ1DP_131117_030600

Receiving EME

- Do you have the right preamp gain and noise figure?
- Is the preamp mounted as close to the antenna?
- Is the preamp properly protected and sequenced?
- What is the loss from the preamp to the receiver?
- Are all relays, coax and connectors tested for loss?
- Avoid right angle adapters.

VNA Very Useful

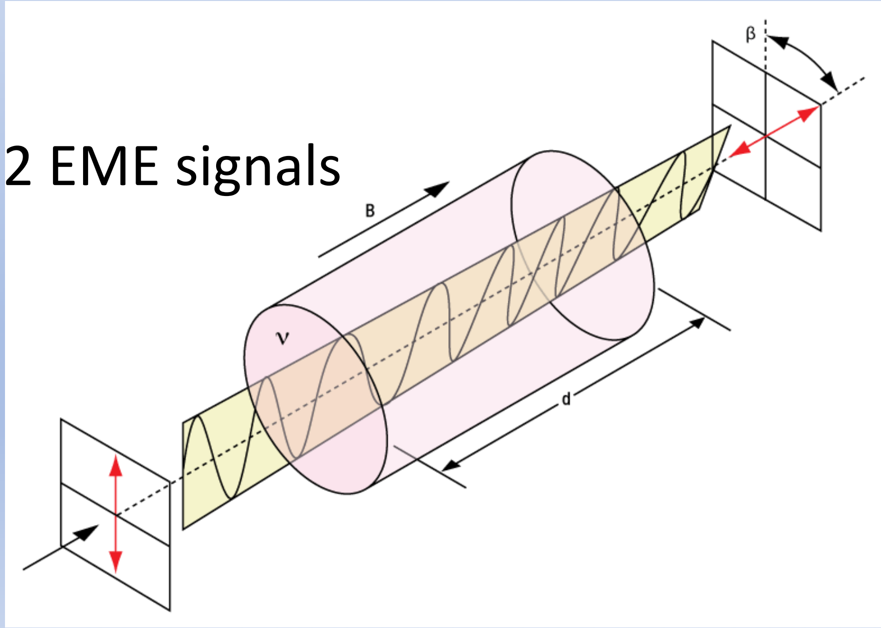
- 【Upgraded NanoVNA SAA-2N V2.2 Version】 Not only testing standing wave impedance of the antenna, can also debug the duplexer, the insertion loss of the filter, the isolation and testing the attenuation of the cable, shorten the coefficient, the phase, the amplification of the antenna amplifier. 4.0 inch touch screen make it easier for you to read data and test
- I’m still learning how to use all the functions. Sells for ~$145 online



FARADAY ROTATION

The Faraday effect or Faraday rotation, sometimes referred to as the magneto-optic Faraday effect (MOFE), is a physical magneto-optical phenomenon. The Faraday effect causes a polarization rotation which is proportional to the projection of the magnetic field along the direction of the beam propagation.

- Will affect linearly polarized 144 and 432 EME signals
- Wait it out
- Dual polarized antennas
- Polarization rotation schemes

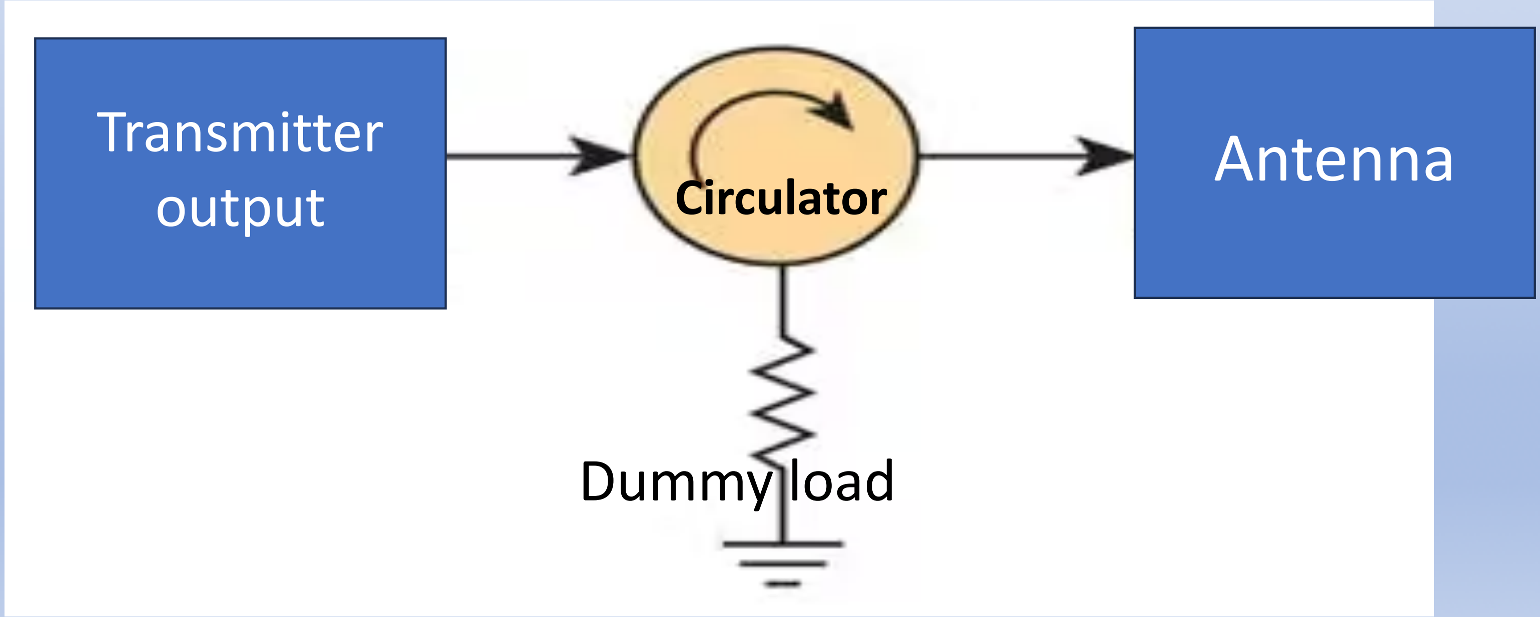


PLEASE USE A SEQUENCER

- You have a powerful transmitter and a very sensitive preamplifier
- They both share the same antenna
- Transmit-Receive relays have variable isolation and power ratings
- Provide grounding through a 50-ohm resistor to the preamp when in transmit
- Have the sequencer switch the relays to transmit position first
- Arm the power amplifier second
- Turn the transmitter on third
- Best to “power the sequencer to receive.” If the sequencer fails, you’ll save your preamp.
- Available through DEMI and others or use a W1GHZ design

Consider Using a Circulator

It is used as Isolator to protect test equipment from undesired reflections. It helps in protecting circuit elements from reverse signal reflections due to mismatch. It is used to protect microwave amplifiers from reflected signals to prevent damage to the amplifier.



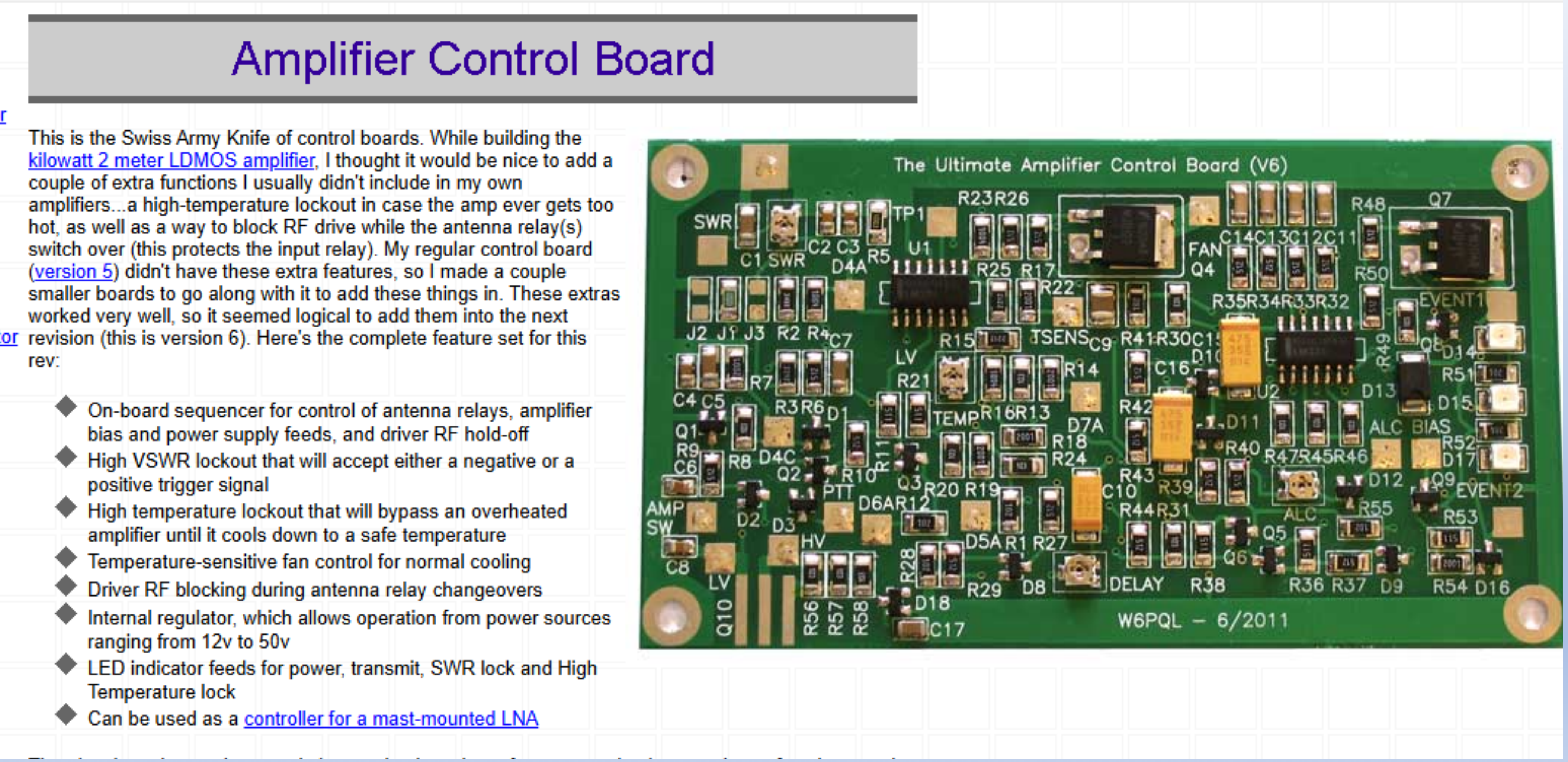
Transmitter output

Circulator

Antenna

Dummy load

https://www.w6pql.com/amplifier_control_board.htm



Amplifier Control Board

This is the Swiss Army Knife of control boards. While building the kilowatt 2 meter LDMOS amplifier, I thought it would be nice to add a couple of extra functions I usually didn't include in my own amplifiers...a high-temperature lockout in case the amp ever gets too hot, as well as a way to block RF drive while the antenna relay(s) switch over (this protects the input relay). My regular control board (version 5) didn't have these extra features, so I made a couple smaller boards to go along with it to add these things in. These extras worked very well, so it seemed logical to add them into the next revision (this is version 6). Here's the complete feature set for this rev:

- On-board sequencer for control of antenna relays, amplifier bias and power supply feeds, and driver RF hold-off
- High VSWR lockout that will accept either a negative or a positive trigger signal
- High temperature lockout that will bypass an overheated amplifier until it cools down to a safe temperature
- Temperature-sensitive fan control for normal cooling
- Driver RF blocking during antenna relay changeovers
- Internal regulator, which allows operation from power sources ranging from 12v to 50v
- LED indicator feeds for power, transmit, SWR lock and High Temperature lock
- Can be used as a controller for a mast-mounted LNA